ANSWERS - AP Physics Multiple Choice Practice – Dynamics

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|  | Solution | Answer |
|  | 1. The key is using the correct normal force acting on the block 2. A free body diagram of the forces acting on the block and an analysis using Newton’s second law yields the answer 3. The diagram suggests that the box is currently moving to the right, and in the process of slowing down due to friction that is causing it to accelerate in the opposite direction. 4. The car’s centripetal acceleration is a =v^2/r, and although the direction of this acceleration is directed toward the center of the circle and therefore keeps changing as the car moves, the magnitude of that acceleration is constant. 5. The horizontal tension of 10 N is matched by the horizontal component of tension in the diagonal cord, while the vertical component of tension in the cord is equal to the uknown weight of the mass. A free body diagram is useful in analyzing the forces. 6. As force increases linearly with time, acceleration will need to increase linearly as well. 7. The box has a net force in the positive-x direction, but the forces in the y-direction are balanced. 8. The blocks all experience the same acceleration, calculated with Newton’s second law, but by analyzing each block using a free body diagram and f=ma, we can determine the net force acting on each block and find the answer. 9. The friction force can be determined by applying Newton’s second law in the x-direction 10. The ramp can be though of as the hypotenuse of a 3-4-5 right triangle, with a corresponding 3-4-5 right triangle as part of the free body diagram for the block. The force of friction when the block just begins to slip equals the force parallel, and the normal force equals the force perpendicular. The coefficient of friction, then, can be calculated. 11. The forces in both x and y directions are balanced, so according to f=ma, the box can’t be accelerating. It may be moving, however – just not accelerating – so c is not a correct answer either. Therefore, none of the statements above is correct. 12. Link A is responsible for pulling the entire mass of the train (m+2m+3m = 6m total) to the right. Link B only needs to pull 5m, and Link C only 3m. | B  E  C  C  C  C  B  E  E  B  E  A |
|  | The “diluted” force between objects is the applied force times the ratio of the mass behind the rope to the total mass being pulled. This can be derived from a = F/mtotal and FT = mbehind the ropea | E |
|  | At t = 2 s the force is 4 N. F = ma | B |
|  | This may be done using impulse/momentum, but also consider dividing the y axis by m = 3 kg to get a graph of a vs t. The area under the line is the change in velocity. | A |
|  | The upward component of the slanted cord is 300 N to balance the weight of the object. Since the slanted cord is at an angle of 45º, it has an equal horizontal component. The horizontal component of the slanted cord is equal to the tension in the horizontal cord. | D |
|  | The normal force must point perpendicular to the surface and the weight must point down. In order to accelerate up the ramp, there must be an applied force up the ramp. If the box is accelerating up the ramp, friction acts down the ramp, opposite the motion. | E |
|  | The normal force must point perpendicular to the surface and the weight must point down. If the box is at rest on the ramp, friction acts up the ramp, opposing the tendency to slide down | C |
|  | The normal force must point perpendicular to the surface and the weight must point down. If the box is sliding down at constant speed, friction acts up the ramp, opposing the motion | C |
|  | ΣFexternal = mtotala gives (Mg) – (mg) = (M + m)a | E |
|  | By Newton’s third law, M1a1 = M2a2, but without the actual value of F, and only a1 and a2 known, we can only find the ratio, not the values, of M1/M2 | C |
|  | For a block on a frictionless incline: FN = mg cos θ and mg sin θ = ma | D |
|  | For an object on an incline: FN = mg cos θ and mg sin θ – Ff = ma, at constant speed a = 0 so mg sin θ = Ff = μFN = μmg cos θ | E |
|  | With acceleration south the car is at the top (north side) of the track as the acceleration points toward the center of the circular track. Moving east indicates the car is travelling clockwise. The magnitude of the acceleration is found from a = v2/r | A |
|  | The car continues forward so the position graph must have a positive slope. The velocity time graph has a slope that approaches zero as the acceleration approaches zero | D |
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